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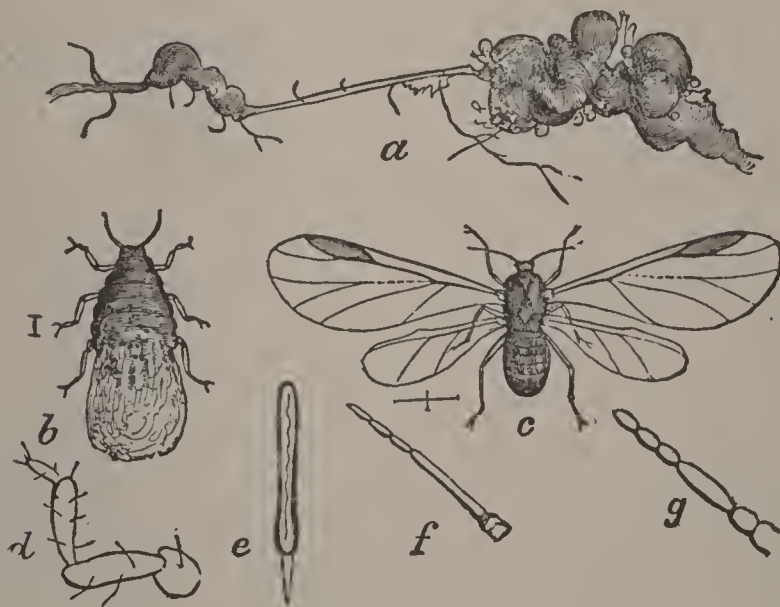
## 7. The Population of an Apple Tree.

A FRENCH author has written a very pleasant little book entitled the "Population of a Pear Tree." Of the population of an apple tree a ponderous tome could be written, but in this essay on the insects injuring this *facile princeps* of our fruit trees, we shall confine ourselves mainly to the more injurious kinds, giving a brief and condensed account of the most important species. About seventy-five species in all are known to prey upon the apple tree. We may first consider those kinds found

### PREYING UPON THE ROOTS.

*The Pear Blight*, or *Eriosoma pyri* (Fig. 127; *a*, the gall; *b*, larva; *c*, female; *d*, leg; *e*, beak; *f*, antenna of female;

FIG. 127.



Blight Insect.

*g*, of larva; after Riley) sometimes causes a good deal of disturbance to the health of the tree, lessening the vigor of its growth and causing the leaves to turn of a paler and more yellowish hue than usual. If there is no borer under

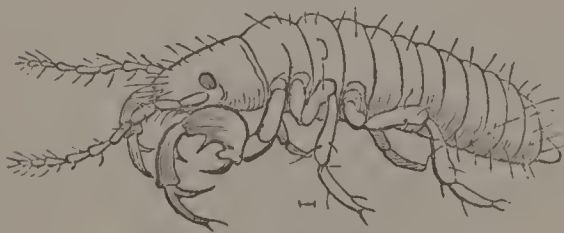


the bark, nor any other apparent cause, and if it be a young tree, it may be found on removing the soil from the roots that a number of gall-like excrescences, sometimes a couple of inches in diameter, are attached to them. On opening the galls a number of small wingless plant lice, with larger winged ones, will be observed in the crevices. Their bodies are covered with a woolly exudation, whence their common name, "woolly blight." Dr. Fitch, who has given us the best account of this annoying blight insect, says that the parent insect at the end of autumn works her way down along the side of the root, there depositing her stock of eggs, and then, the grand aim of her life accomplished, she dies. When the ground becomes warm in spring the young appear and forthwith plunge their beaks into the bark. The beak thus inserted acts like a seton in the flesh of an animal, and keeps up a constant irritation. An abnormal cell-growth sets in, bringing about a permanent enlargement, which undermines the health of the tree. It is especially injurious in nurseries of young trees.

Dr. Fitch wisely recommends that when the tree is found to be infested, it should not be thrown away, but the roots should be dipped in soap suds, and when replanted a shovel-ful of ashes should be mixed with the dirt. This insect is a near ally of the famous *Phylloxera* of the vine.

Another insect not usually suspected of injuring the apple

FIG. 128.



Young Cicada.

by sucking the sap of the roots is the young of the Cicada (Fig. 128, enlarged), which lives for sixteen years sucking the roots usually of the oak, but is sometimes liable to attack the roots of

the apple. It may be imagined that sixteen years' drainage of the sap of the tree is a pretty serious matter. The young insect lives a foot or two beneath the surface of the

ground. The Cicada also at times breaks off the twigs of the apple in laying its eggs in them.

#### INFESTING THE TRUNK OF THE TREE.

*The Apple Tree Borer.*—It is not particularly creditable to our fruit growers that the apple tree borer still maintains such a sway in our orchards, and that we pay an annual tribute of trees and apples which, were its value set forth in figures, would appall the orchardist. The borer is the most widely extended and wholesale in its destruction of all the insects which prey upon the apple. The canker worm is local, and even then less injurious, taking only the leaves and apples, but leaving the trees. So with the tent caterpillar and bud worm; but the “borer” has almost finished its work of destruction and the tree is doomed, ere we have read its death-warrant. The history of this beetle is as follows: during the night and sometimes in the hottest days of the first week of July, in New England, and in May and June in the western states, the female beetle flies around the trunk of the tree, and during this period she deposits her eggs in the bark near the root of the tree. How many eggs she lays at one time is not known, but she deposits “one egg in a place upon the bark, low down, at or very near the surface of the earth; but when these beetles are numerous, some of their eggs are placed higher up, particularly in the axils where the lower limbs proceed from the trunk” (Fitch). About a fortnight after the eggs are laid the young grub hatches, and immediately begins to eat its way upwards (according to Harris) or downwards (according to Fitch). This grub is a little footless white worm, with the segment next to the head large and thick, and only differs in size from the fully grown worm (Fig. 129; *b*, pupa; *c*, beetle, after Riley). Says Dr. Fitch, “If the outer dark colored surface of the bark be scraped off with a knife the last of August or forepart of September, so as to expose the clean

white bark beneath, as can easily be done without any injury to the tree, wherever there is a young worm it can easily be detected. A little blackish spot, rather larger than a kernel of wheat, will be discovered wherever an egg has been deposited, and by cutting slightly into the bark the worm will be found. It gradually works its way onwards through the bark, increasing in size as it advances, until it reaches the sap-wood; here it takes up its abode, feeding upon and consuming the soft wood, hereby forming a smooth, round, flat cavity, the size of a dollar or larger, immediately under the bark. It keeps its burrow clean by pushing its excrement out of a small crevice or opening through the bark, which it

FIG. 129.



Apple Tree Borer.

makes at the lower part of its burrow, and if this orifice becomes clogged up it opens another. This excrement resembles new fine sawdust, and enables us readily to detect the presence of the worm by the little heap of this substance which is accumulated on the ground, commonly covering the hole out of which it is extruded, and by particles of it which adhere around the orifice when it is higher up, or in the fork of the tree; the outer surface of the bark also often becomes slightly depressed, or flattened, over this cavity."

When half grown it sinks into the solid heart wood of the tree and obliterates the flat cell, filling it up with its casting,



and lives in a cylindrical hole; it then ceases to eject its castings, simply pushing them behind it. According to Riley, it is within a few days of three years old before it is ready to change to a pupa, instead of two, as generally stated. Before it becomes fully grown it leaves the heart of the tree and makes its way to the bark, just beneath which it transforms, making a rude cocoon of chips eight or ten inches from its starting point. It pupates late in the spring in May, and appears in June and early in July. The beetle (Fig. 129, c) is a brown beetle with long antennæ, with two distinct white stripes. Its primitive home is the June berry and mountain ash, while it also infests the hawthorne, wild apple, the quince and sometimes the pear.

Having become acquainted with the habits of the insect, we are prepared to deal in an intelligent way with it. When the tree is found to be badly infested the readiest way is to cut the worms out, or pour in boiling water. In the autumn the bark should be carefully examined and the young worms be dug out. The best preventive measure is to apply soap to the trunks of young trees in June, or in May in the western states, and surround the trunks with tarred paper. This will baffle the beetle in laying her eggs.

*The Buprestid Borers.*—Two beetles of this family infest the trunk of the apple in their larval stage. They have hard bodies with a rough exterior, and have the power of snapping up in the air when placed on their backs.

The most common is *Chrysobothris femorata* (Fig. 130, natural size; a, larva). The grub is much flattened behind the head, forming a rounded expansion, behind which the body is



FIG. 130.

*Chrysobothris.*

slender and cylindrical. This is the characteristic form of the larvæ of this extensive group of borers. The grub lives a year under the bark of the apple and oak. The beetle is

greenish black above, with a brassy hue especially on the raised transverse spots. It may be seen from May until July sunning itself on the bark of the trees in the crevices of which it inserts its eggs. As in the common borer just described it gnaws its way into the heart of the tree, but it only lives over one summer. From the flattened form of its body it makes a broad, flat, and not a cylindrical hole, like that of the common borer, the gallery a little over an inch in length leading upwards from where the young larva began to work. A very similar species, *C. Harrisii*, or Harris' apple borer, is sometimes very destructive to the apple, though the red maple seems to have been its original home. The same remedies should be applied in dealing with these borers as with the young of the striped beetle.

*The white-lined Psenocerus.*—Though this beetle in the larva state is more commonly found tunnelling the stems of

FIG. 131.



Psenocerus.

currant bushes, and sometimes boring into grape stems, yet it has been known to be injurious in apple orchards. The beetle is a "longicorn," with a very round, cylindrical body. It is dark reddish-brown, with a swelling at the base of the wing-covers, an oblique yellowish white line on the basal third, and a broad curved white line on the outer third of the wing-cover. The grub (Fig. 131, enlarged about three times) is nearly half an inch in length, with a honey yellow head scarcely half as wide as the body, while the segments of the body are rather convex, each having two rows of minute warts. It devours the sap wood and inner portion of the bark and also the pith of the branches, thus locally killing the terminal twigs, and causing the bark to shrivel and peel off, leaving a distinct "dead line." Each grub lives in a burrow about an inch and a half long, and five such burrows occur in a portion of the branch five inches long. The grubs become fully grown during the middle of August. Dr. Fitch



says that about the first of June the female deposits her eggs. The grubs change to chrysalides early in the spring, and in New York the beetles appear early in May.

The *Cylindrical Bark Borer*, or *Tomicus mali*, produces a disease like fire-blight, causing the bark to shrivel and peel off and killing the branches. Dr. Fitch states that young, thrifty trees when attacked by this beetle soon after putting forth their leaves in the spring suddenly wither as though scorched by fire, the bark becoming loosened from the wood, and soon after numerous perforations like pin holes appear, revealing the secret of the sudden destruction befalling the tree. All these bark boring beetles have a common form, that of a cylinder squarely docked at the end, looking as though they had been made by the inch and then cut up into lengths of about a line each. The body is cov-

FIG. 132.



Tomicus.

ered over with fine hairs, so that it acts as a brush, like those used for cleaning lamp chimneys. The end of the body is sometimes scooped out like a gouge, so that the little beetle can shovel out the dirt from its house in a true Milesian fashion. The use of the hairs undoubtedly is seen when the insect lays its eggs. The female beetle tunnels a hole in the bark and makes little notches at intervals, in which it deposits an egg. On her return, by means of the short stiff hairs projecting from her body, she brushes the dirt into the little notches, thus covering up and protecting her eggs. Figure 132 represents the *Tomicus xylographus*, enlarged several times. This is a timber beetle, and there are several allied forms, but all are much like the apple bark borer. It seems from the observations of M. Perris, as quoted by Dr. Fitch, that the bark boring beetles, *i.e.*, those infesting fruit trees, differ from the timber beetles in an interesting peculiarity. In the bark beetles there is a division of labor, the males doing most of the work. "There are commonly several males in company with but

one female, and the former appear to perform the chief part of the labor in the excavation of their galleries. With the timber beetles, on the other hand, the females are much the more numerous, and probably mine their galleries without any assistance from the other sex. M. Perris states of one of the species, that upwards of fifty females were met with in the burrows they had excavated, without a single male being found there."

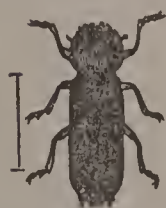
As the young hatch out they run galleries either at right angles to the original one, or branching out in every direction, though never intercrossing. In this way those that confine themselves entirely to the sap wood and inner bark loosen it, interrupt the circulation of sap and kill the branch affected.

*The Apple Twig Borer* or *Amphicerus bicaudatus* (Fig. 133) is an exceedingly annoying beetle in the middle and

western states. It somewhat resembles the bark boring beetles, but belongs to a different family. The grub is not known with certainty to burrow in the apple, but the beetles late in the summer bore into the twigs of the apple, beginning, ac-

Amphicerus. cording to Riley, just above a bud or fork, whence it bores downwards an inch and a half into the twig, usually in wood of the previous year's growth. "Both the male and female beetles bore these holes, and may always be found in them head downwards during the winter and spring months. The holes are made for food and protection, and not for breeding purposes." As a preventive measure the infested twigs should be cut off and burned, the trees being looked over in the autumn.

*The Prickly Leptostylus* is the last borer which we have on our list of boring beetles. Dr. Fitch says that the grubs are like the young of the apple tree borer, and sometimes "occur in multitudes under the bark, forming long, narrow, winding tracks upon the outer surface of the wood, these



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tracks becoming broader as the worm has increased in size." The beetle appears late in August in New York. It is a brown beetle, its wing-covers prickly, whence the name *Leplostylus aculiferus*, and with a white, curved or V-shaped band behind the middle of the wing-covers, and a black streak on their hind edge. It is about a third of an inch long.

The *Apple Leiopus* (Fig. 134) is a new comer in our orchards, having lately been found in all its stages of growth

FIG. 134.



Apple Leiopus.

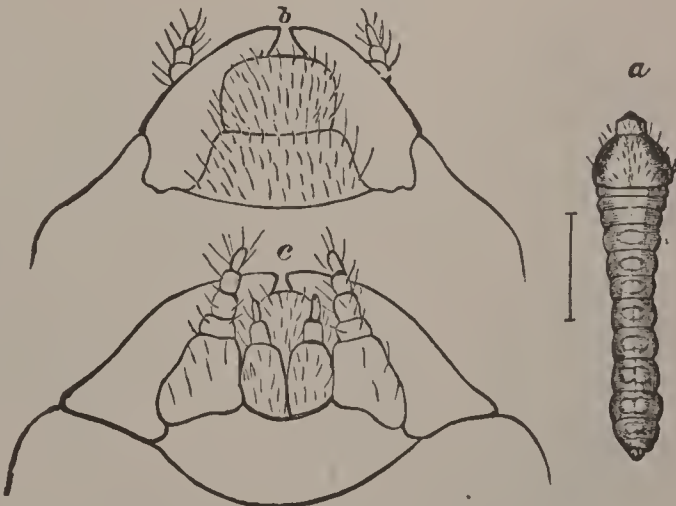
FIG. 135.



Leiopus of Prickly Ash.

in the rotten limbs. The grub is so closely allied to that of another species, *Leiopus xanthoxyli* (Fig. 136, beetle; 136, *a*, larva; *b*, head seen from above; and *c*, seen from beneath), that a wood-cut drawing will answer for both. It differs mainly in having a smaller head and a slenderer body. It seems from what little we know of the habits of these insects that there is probably but

FIG. 136.



Larva of *Leiopus xanthoxyli*.

one brood of beetles a year, and that they fly about and lay their eggs on the bark of the tree late in June, and probably

during July. Upon hatching, the young larvæ bore in under the bark, and become fully grown in the autumn, spending the winter under the bark, probably both in the larva and pupa states, the beetles appearing during midsummer.

*The Scale Insect, Mytilaspis pomorum* (Bouché) or *Aspidiotus conchiformis* of different authors, Fig. 137.—This, next to the borer, is by far the most prevalent and destructive enemy of the apple tree. The scale surrounds the body of the female, while the male is two-winged and flies about actively. It closely resembles the Pine scale insect figured on page 39. The female lays her eggs (Fig. 138, 1) in August under the scale protecting her body, and the young (2) hatch out in June, when they may be found running over the bark. By the middle or last of the month they become anchored by their long hair-like beak, and the day after, as Riley states, a white waxy secretion begins to issue from the body, as seen in 3. During a period from the 6th to the middle of July, the larva loses

FIG. 137.

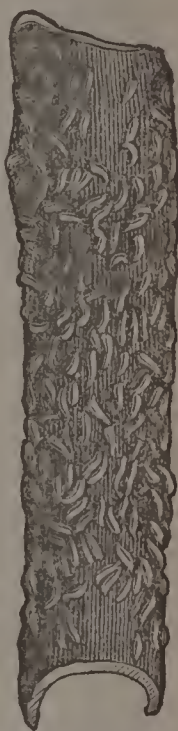
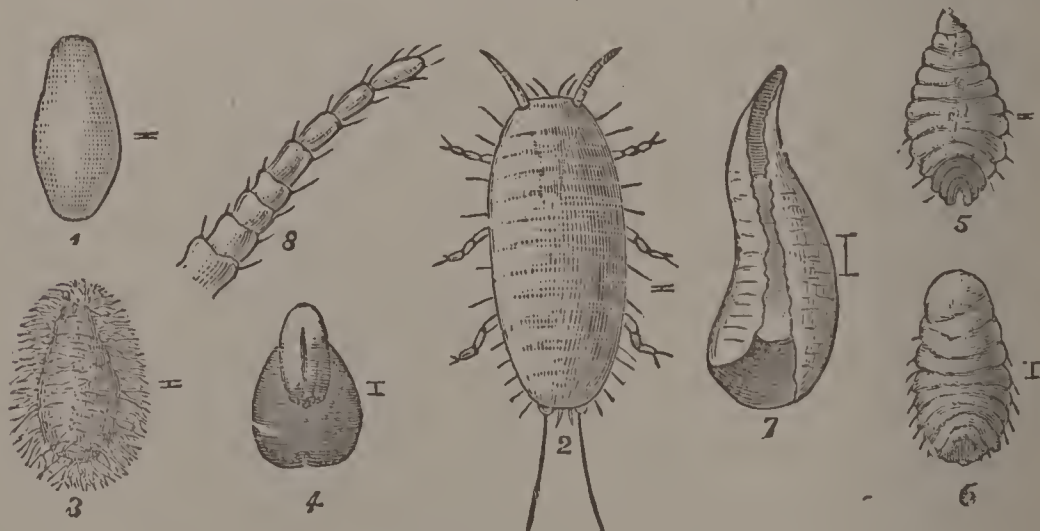
Scale Insect,  
natural size.

FIG. 138.



Apple Scale Insect.

its legs and feelers and assumes the form of the adult female (5). Soon after the insect moults, and its cast skin remains



attached to the insect as at 4. By the first of August the growth of the scale insect is completed, and it has the appearance of an oyster shell, as seen at 7. By the middle of August in the western states, where Mr. Riley studied its habits, the female lays her eggs, which do not hatch till the following June. It will be seen that the best method of warding off the attacks of this pest is to thoroughly scrape the bark of the tree in the early autumn and again in the beginning of June, when the young are swarming over the surface of the bark. At this time the bark should be washed with whale oil soap. But it is to the natural insect parasite when reared and set loose in the orchard that we are to look for the means of restraining within proper limits this insect. This is the minute ichneumon fly (*Aphelinus*) figured on page 42.

The majority of the insects injurious to the apple are found

#### FEEDING ON THE LEAVES.

*The American Tent Caterpillar*, or *Clisiocampa Americana*, is known to every farmer's boy from the social habits of the caterpillar, which lives protected from the hot sun or inclemency of the weather under a broad tent of white silk. Not very creditably to orchardists and farmers they are a conspicuous object at the beginning of summer, whether in the New England, Western or Middle states. The caterpillar is easily recognized by its large size, being about two inches in length, and by the long brown hairs and bright colors of the body, which is yellow with numerous fine crinkled black lines, forming low down on the sides of the body a black band, with a blue spot on the side of each ring. Along the middle of the back is a conspicuous white stripe. It becomes fully grown by the first or middle of June, the period varying with its geographical position. When about to make its cocoon it stops eating, and wanders restlessly about in search of a suitable place in which to spin. Under

a board or overhanging piece of bark or in any nook or cranny it settles and spins, in the course of a day or two, a dense white cocoon, often of a yellowish color, which is much like that of the common Chinese silk worm, except that it is more pointed at the ends. Our tent caterpillar is not a remote ally of the silk worm, belonging to the same natural family. The supply of silk is by no means exhausted after it spins its cocoon, for if it be removed from its silky house, after a few hours it surrounds itself by a fresh one, and even attempts a third if compelled to by the curiosity of the experimenter. It remains in its cocoon through the remainder of the month, the moth appearing early in July, when it enters our rooms with a headlong flight, and dashes in a peculiar, confused manner upon the table. The moth is unusually thick-bodied and hairy. It is reddish-brown, with two oblique, dirty white lines on the fore wings, and expands about an inch and a quarter.

The female immediately lays her eggs in a mass of three or four hundred, standing up side by side around a twig and covered by a gummy secretion. These bunches of eggs form conspicuous objects, and it is easy to pick them off after the leaves have fallen. Before the winter opens the embryo caterpillars are formed and lie in the egg shell all ready to hatch. In the spring they hatch out just as the leaves are beginning to unfold; and it is curious to watch the habits of the young caterpillars as they gather in colonies and gradually spin a silken tent in a fork of the branch. They lay down silken paths in every direction over the branches, over which they travel back and forth, their journeys becoming longer as the leaves disappear before their ravenous jaws. They work in the forenoon and afternoon in pleasant days, taking a siesta at noon, or in stormy weather huddle up together upon or under their silken canopy. This caterpillar, so large and conspicuous, is easily dealt with, as the nests can be easily removed by a brush or mop dipped

in strong soap suds or a weak solution of coal oil or carbolic acid.

The original home of this moth is the wild cherry. Another closely allied species sometimes found on the apple, for which it deserts its favorite food-tree, the oak, is the Forest tent caterpillar. It differs from the other species in having a row of spots along the back instead of a continuous line. The moth differs in the wings being more pointed at the apex, and in the transverse lines being rust brown.

Not only do certain carnivorous beetles and a parasitic fly (*Tachina*) prey upon the caterpillar, but we have also found a small chalcid fly lurking under the mass of eggs, in which it was undoubtedly parasitic.

*The Canker Worm.*—The traveller through eastern Massachusetts, particularly in the neighborhood of Boston, is often struck during the early weeks of June by the desolate appearance of the orchards, which look as if a fire had passed through them. There is not a green thing on the trees, but all the branches are hung with a multitude of skeletonized leaves, rusty, sere, and fluttering feebly in the breeze. This is not the work of fire, but an evidence of the industry of the canker worm. This scene has been repeated ever since the apple has been raised, or at least for a century, and is liable to be repeated for a hundred years to come, unless a law is enacted to compel negligent farmers and gardeners to properly protect their trees. When the buds of the apple leaves are opening we shall on careful examination find a few little dark worms scarcely thicker than a horse-hair, nibbling the exposed edges of the opening leaves. Before people are aware of it these tiny caterpillars become nearly an inch long, and defoliate the tree. One can stand near the tree and hear the nibbling of thousands of little teeth. No one attempts to arrest the progress of the destroyers, and their advent is looked upon with dismay, mingled, however, with a large proportion of fatalism. No one



seems to attempt to remove them. The loss of the leaves does not kill the trees, but prevents the growth of any apples. When these canker worms are fully grown, *i.e.*, about four or five weeks after they are hatched, between the 17th and 27th of June about Boston, they will be found to vary exceedingly in color, some individuals being blackish, others greenish-yellow. The average style of coloration is an ash color on the back, beneath yellowish, with a black stripe on the sides. It has a less number of feet than most caterpillars, which gives it a halting, looping gait, as if carefully measuring the ground over which it is walking; hence the name geometer. Deserting its tree top it either creeps down the trunk of the tree, or lets itself down after the manner of most caterpillars by means of a silken thread spun from a little opening in its under lip. It doesn't wander about, but immediately burrows from two to six inches in the loose soil under the tree, and then forms a rude loose earthen cocoon, fastening the particles of dirt together with silk. Twenty-four hours after the cocoon is finished the worm changes to a chrysalis, which is rather pointed in front and light brown in color. Here the insect remains until after the October frosts, when on warm days between the cold snaps late in October, and in November and December, and even in some exceptionally warm days during the rest of the winter, the adult insects come forth.

Nature has endowed the sexes quite differently; the male is winged and flies about in a modest Quaker garb of gray, fluttering with broad weak wings about the trunks of the trees and paying court to the grub-like wingless females, which are less flighty than their mates. A larger proportion of individuals appear in the spring than winter. This provision of nature that a part of the brood shall appear in the autumn and a part in the spring ensures the life of the species, since if it were not represented in part by the eggs and chrysalides, a severe winter might destroy the latter,

and cut off the brood. The eggs have so thick a shell that it seems impossible that even great extremes of temperature should destroy them. They are laid in broad patches of from sixty to a hundred or more, standing up side by side. They are glued together and to the bark or paling by a grayish varnish, secreted by a gland in the end of the body.

In dealing with this caterpillar the obvious preventive measure is to keep the females from ascending the trunks of the trees and laying their eggs on the branches. This is done in a cheap and efficacious way by surrounding the trunk of the tree with a band of tarred paper and anointing it with printer's ink. If the ink is daily applied this is a cheap and sure preventive. Another one, involving more expense but less time and trouble, is to surround the base of the trunk with a wooden trough kept filled with oil or ink; or it may be raised and made of zinc, and filled with whale oil. But all these methods are useless unless the shiftless and careless are compelled to coöperate with those who take pains to keep their trees free from the caterpillars. We have ventured to suggest, in our first "Report on the Injurious and Beneficial Insects of Massachusetts," that it is only by combination between farmers and orchardists that these and other pests can be kept under. As we then said, "The matter can be best reached by legislation; we have fish and game laws, why should we not frame a law providing that farmers, and all those owning a garden or orchard, should coöperate in taking preventive measures against injurious insects, such as early or late planting of cereals to avert the attacks of the Wheat midge and Hessian fly, the burning of stubble in the autumn and spring to destroy the joint worm, the combined use of proper remedies against the canker worm, the various cut worms, and other noxious caterpillars. A law carried out by a proper state entomological constabulary, if it may be so designated, could com-

pel the idle and shiftless to clear their farms and gardens of noxious animals." We trust that those interested will not suffer this matter to drop, but that a law correcting this abuse of privilege in letting these destructive insects run riot may be framed and passed.

Among the natural enemies of the canker worm is the *Calosoma scrutator* (Fig. 139), a beautiful ground beetle which ascends the trunks of the trees and devours the caterpillars. Certain wasps, particularly the Eumenes, store up the caterpillars in their nests. The Tachina fly, and an ichneumon fly, are also said to

FIG. 139.

*Calosoma scrutator.*

prey on them, while hogs and fowl devour the chrysalides. Next to the parasitic ichneumons, however, the smaller birds are the most efficacious in destroying them. I extract as follows from a paper in the "American Naturalist" (May, 1874) important testimony on this point:—

"I am indebted to Mr. C. J. Maynard of Ipswich for the following information upon the birds which devour the canker worm. He informs me that in the course of his investigations he has opened the stomachs of some three thousand birds.

'In answer to your questions relative to birds eating canker worms and the larvæ of other injurious insects I would say that upon examining my notes, I find that I have taken canker worms from the stomachs of the following species:—red-eyed vireo (*Vireo olivaceus*), song sparrow (*Melospiza melodia*), chickadee (*Parus atricapillus*), scarlet tanager (*Pyranga rubra*), robin (*Turdus migratorius*), black billed cuckoo (*Coccygus erythrophthalmus*), wood pewee (*Contopus*



*vireus*), least pewee (*Empidonax minimus*), Wilson's thrush (*Turdus fuscescens*), black and white creeper (*Mniotilta varia*), blue yellow-backed warbler (*Parula Americana*), Maryland yellow-throat (*Geothlypis trichas*), Nashville warbler (*Helminthophaga ruficapilla*), golden-crowned thrush (*Seiurus aurocapillus*), chestnut-sided warbler (*Dendroica Pensylvanica*), yellow warbler (*D. æstiva*), black and yellow warbler (*D. maculosa*), prairie warbler (*D. discolor*), black-poll'd warbler (*D. striata*), Canada warbler (*Myiodiotes Canadensis*), redstart (*Setophaga ruticilla*), cedar bird (*Ampelis cedrorum*), cat bird (*Mimus Carolinensis*), purple finch (*Carpodacus purpureus*), white-winged crossbill (*Curvirostra leucoptera*), chipping sparrow (*Spizella socialis*), indigo bird (*Cyanospiza cyanea*), red-winged blackbird (*Agelaius phoeniceus*), cow blackbird (*Molothrus pecoris*), bob-o-link (*Dolichonyx oryzivorus*), Baltimore oriole (*Icterus Baltimore*).

'Possibly this list may be increased. Besides these birds, those species which occur in orchards during autumn and winter, such as the ruby crowned wren, brown creeper, nut-hatches and titmice, doubtless eat largely of the eggs of canker worms and other insects which destroy or injure the trees. Winter birds of the above species which I have shot at this time have their stomachs crammed with insects of some kind.

'As I remarked to you the other evening, the Baltimore oriole will eat largely of the tent caterpillar, and is the only bird which will do this.

'All the thrushes will eat wire worms. The swallows destroy multitudes of dipterous insects (gnats, etc.). In fact, to sum the matter up there is scarcely a bird which will not eat largely of insects at certain seasons, when these pests are most abundant.

'It is a noticeable fact that many species inhabiting woods and meadows, as may be seen by the list given, leave their

usual haunts and visit the fruit trees which are covered with canker worms and largely devour them.

‘In reference to the currant saw fly worm (*Nematus ventricosus*) I am not certain that I have seen any birds eat them, yet I think the truly insectivorous species will do this.’

“That the Baltimore oriole sometimes eats large quantities of the American tent caterpillar (*Clisiocampa Americana*), since they have been found in the stomach of this bird by Mr. Maynard, is an interesting fact, for birds as a rule do not relish hairy caterpillars, and the American tent caterpillar is covered with long hairs, though they are not so dense as in some other larvæ. In Europe the closely allied tent caterpillar (*C. neustria*), and those of the *Cnethocampa* and *Liparis chrysorrhæa* are said by Perris and others to be almost untouched by birds. I have been told by Dr. T. M. Brewer of Boston that the English sparrows upon the common devoured all the caterpillars of the tussock moth (*Orgyia*) which were injuring a fine tree. These caterpillars are very hairy, being adorned with pencils and tufts of long hairs.

“Mr. John H. Sears, of Danvers, Mass., who has paid much attention to the habits of our birds, informs me that the cuckoo, which breeds near houses, is an exceedingly useful bird, as it devours the canker worms in large numbers. It is well that this should be known, as there is a popular prejudice against this bird, from its habit of sucking the eggs, as well as laying its eggs in the nests, of other birds. Among the birds which he has himself observed in the act of eating canker worms, are the king bird, the Baltimore oriole, the cat bird, the common flycatcher, the least flycatcher or wood pewee, the red eyed vireo and a few other small birds, such as certain warblers and flycatchers. The king bird in the month of May feeds on May beetles, as stated by Mr. J. L. Hersey, in this journal.

“I also quote from a letter on the subject, for which I am indebted to Dr. T. M. Brewer:—

‘The most noticeable of all the destroyers of the canker worm is the common cedar bird, which devours them to an extent perfectly enormous. Next is the purple grackle which also feeds on them as long as they last. The house pigeon, if in any numbers, is an invaluable bird. See, for instance, a garden corner of Summer and Chestnut streets, Salem, where the pigeons make canker worms a thing unknown. Among the other birds, all excellent so far as they go, are the chipping sparrow, the song sparrow, the purple finch, all the vireos, white-eyed, red-eyed, yellow-throated, solitary and warbling, the king bird, the cat bird, the downy woodpecker, the summer yellow bird, Maryland yellow throat, the blue-bird. The bluejay eats their eggs in the winter, so does the chickadee. The latter eats their grub also and the worm too. The common gray creeper, which is with us only in the winter, eats the eggs.

‘Last summer I had a nest of golden-winged woodpeckers breeding on my place at Hingham. Some of them dug into my barn and passed the winter. Only a part of my trees were protected by a belt of printers’ ink and some of them were partially eaten, but this winter very few grubs have as yet shown themselves, and I give my friend, *Colaptes auratus*, the credit of all this. I know this—I gave the young ones a lot of worms myself and they ate them as if they were used to them. The old birds were too shy to permit me to see their good deeds.

‘I think the golden robin feeds its young with them as long as they last, but I am not sure that they eat the tent caterpillar. I nearly forgot the two cuckoos, yellow-bill and black-bill. They eat every form of caterpillar, canker worms included. I do not think the robin feeds any to its young, because it would never do; they are too small, and its brood want a big lot. I have known the robin to feed its young



for entire days, as fast as they could bring them, with the moth of the cut-worm. That is about as much as we could expect any bird to do at one time. At the rate they went, they must have caught and given their young ones about five hundred of these moths in a day. Before that, I had supposed that the robin did me more harm than good, but I had to give in. My indebtedness to that pair was worth all the cherries I could raise in many years. So the robin and I are fast friends.'"

From the facts already presented, it may be inferred how useful birds may become in the work of reducing the number of injurious insects. Undoubtedly we have suffered greatly by our wanton killing of the smaller birds. We are far behind European nations in caring for the insect-eating kinds, and providing nests for them about our houses and gardens. The Swiss and French have been the most far-sighted in this matter of the protection of the smaller insectivorous species. The English, Scandinavians and Germans foster them, while in our country, teeming as it is with hosts of ravaging insects, the smaller birds are hunted and persecuted, or if let alone, there is no effort made on any extended scale to invite them to our houses and gardens.

*The Apple Sphinx*.—This modest gray hawk moth, rather smaller than the generality of the species, appears in June and lays scattered eggs on the leaves, from which the caterpillars hatch. They are large, pea-green worms, with seven oblique violet stripes along each side, and a horn on the end of the body. It is the *Sphinx gordius*. The larva of another hawk moth, with a rough granular skin, a bluish horn and seven yellowish white streaks on the side, is also found on the apple. The moth is fawn colored, with the wings notched, the hinder pair bearing a large black eye-spot centred with blue. It is the *Smerinthus excrucatus*.

*The Swallow Tail Butterfly*.—The caterpillar of *Papilio Turnus* is occasionally found on the leaves of the apple. It

is a smooth, fat, green worm, with two eye-like spots behind the head. It changes to a chrysalis in August. These three caterpillars do little or no harm to the tree, and are only mentioned on account of their large size and curious appearance.

*The Apple Nola.*—We have not ourselves identified the caterpillar of this well known moth. It is said by Dr. Fitch to be a rather thick, cylindrical, light green worm, an inch long, with five white lines and numerous white dots, and was observed eating notches and holes in the leaves. It changes to a cocoon in a curved leaf. The moth appears in July, and also hibernates, flying about in spring. It is gray, crossed by three zigzag black lines. It is the *Nola malana*.

*The Bud Worm.*—One of the most injurious insects of the apple tree, next to the canker worm, that we have, is a small, reddish-brown larva, which, during certain years, threatens, in some localities, the extinction of our apple crop. It was described by Harris, in his "Treatise on the Insects injurious to Vegetation," under the name of *Penthina oculana*, and should now be named *Grapholitha oculana*. The caterpillar is a small, cylindrical, naked worm, about a third of an inch in length, and of a uniform reddish-brown, with small warts, from which arise short, fine hairs, while the head and upper side of the prothoracic ring, or segment next the head, is black.

On May 16th I noticed this caterpillar on the apple, and also the pear and cherry, perforating the half expanded leaf and flower buds. They were very abundant on these buds, and afterwards, when the leaves had partially expanded, they had folded them. It seems to hatch out about the time that the canker worms and American tent caterpillars leave their eggs, that is, about the first day of May, when the buds unfold. The last of May and the first week of June they were swarming in orchards throughout eastern

Massachusetts, many persons noticing their attacks; and it seems to be a common insect all over New England. When fully grown it crumples the leaves, disfiguring the whole tree, and doing great damage to the fruit-buds and flowers, thus directly lessening the apple and pear crop. About the first of June they cease eating, and make a loose, delicate silken cocoon in the folded leaf. They remain several days—sometimes nearly two weeks—in this condition before assuming the chrysalis state, about the 16th of June, and the moths are seen flying about and entering houses, attracted by the light within, during the last week of June and the first of July. The chrysalis is brown and of the usual shape, and, as Harris states, has but a single row of teeth along the dorsal side of each abdominal segment. After the moth has slipped out of the pupa case, the empty shell remains attached by the tip of the abdomen to the surface of the leaf.

The moth is of a dark ash color, the fore wings being usually paler in the middle. The basal third of the wing is dark ash mottled with paler scales, the outer edge of the dark area being angulated just behind the middle of the wing. The costa is marked with light and dark bands. On the outer third the wing is nearly as dark as on the base: near the outer edge, and half-way between the costa and hind edge, are four well-marked longitudinal black spots, or short lines running parallel with the costa, or front edge, of the wing; the one nearest the costa is simply an elongated dot, the second and largest is an oblong spot and twice as wide as the third spot, while the fourth again is much smaller. There are three similar black marks situated on the inner edge at the outer third of the wing. When the wings are folded over the back, these black marks, collectively, make a rudely triangular figure. The outer third of the wing is also variously banded and mottled with leaden blue and tawny brown scales. The fringe is brown and



leadен blue. The hind wings are dark ash brown. Beneath, the fore wings are not mottled, but uniformly dark ash brown, and a shade lighter than the upper surface of the hind wings. It expands about  $\cdot 55$  of an inch.

It varies in the distribution of the black spots, and in the degree of angularity of the outer edge of the basal dark portion of the fore wings; and in some specimens the middle of the wing is concolorous with the other parts, and the peculiar leaden blue scales are scattered over the whole wing, with a black patch on the inner third of the wing near the inner edge. In some specimens there are more than four dots near the outer edge of the wing, forming a transverse row.

As these worms attack the fruit and leaf-buds, it is difficult to pick them off by the hand without injuring the buds; nor is it easy to apply whale-oil soap or a weak solution of carbolic acid. Both of these remedies, however, should be tried, especially showering the terminal branches of the tree with soap suds or a very weak solution of carbolic acid. A faithful application, for one season, of these and other remedies, will materially lessen the numbers of this formidable pest.

*The Palmer Worm.*—During the latter part of June, as observed on the Hudson River, the leaves of the apple become badly worm-eaten, with the remnants carelessly sewn together with fine silken threads. When the bunch of leaves is disturbed, out scrambles a pale yellowish green caterpillar, with a dusky stripe along each side, edged above with a narrow white stripe, and drops a few inches, hanging suspended by a thread. This is the Palmer worm described under the name of *Chætochilus pometellus* (Harris).

This insect has not been of late years at all common in our orchards. We have had no personal acquaintance with it, and the following account of it is condensed from Fitch's admirable description. There are insect years as well as

apple years. Seasons when through favoring causes certain species appear in extraordinary numbers. The causes would not seem to be wholly climatic, for during seasons that may seem to be peculiarly favorable to insect life, every species does not abound in equal numbers. It seems more probable that the increase in a species is owing to a decrease in the numbers of the ichneumons attacking it, though the causes leading to the partial extinction of the ichneumon may be unknown. How full of interest would be a study of such phenomena as the periodical or unusual abundance of certain animals! No subject could be more attractive to the biologist, while none is of more practical importance to the gardener or farmer; and it is just such studies as these that our young students should take up.

“In the year 1791,” says Fitch, “the orchards and forests of New England were overrun by this worm, and the leaves of the apple, oak and other trees were devoured by it. It was at this time that it received the name ‘Palmer worm,’ by which it has since been currently designated. This name was evidently derived from our English translation of the sacred scriptures. Another insect, which a month or two before had devastated the fruit trees to an extent never previously known, appears simultaneously to have received the name which it still retains, the canker worm; for previously to this date we find this name given to what is now called the army worm.” (*Leucania unipunctata*.) “Another remarkable visitation of these insects occurred in the year 1853, unparalleled by any event of this kind within the memory of the present generation.” It appeared “suddenly in excessive numbers” from Maine to eastern New York. The Palmer worm appears about the middle of June, about the time the canker worm is entering the earth, and continues till the close of the month. It strips off the foliage, thus emulating the gastronomical feats of the canker worm. Dr. Fitch says that should, “after a visitation from these worms,

the weather during the month of July prove to be dry and hot, as it frequently is, the damage is much more extensive, whole orchards and forests perishing." In 1853 the worms "continued in full force until the night of the 23d of June, when brisk showers occurred, accompanied with heavy thunder, terminating the drouth which had prevailed, and with this the worms suddenly disappeared." In one orchard a thousand bushels of apples were destroyed, that being the usual yield. "When they are young these worms eat only the green pulpy tissues of the leaf, leaving its net-work of veins entire. But as they become larger and more robust they consume the whole of the leaf, except the coarse veins. It is the young and tender leaves, however, which grow at or near the tips of the limbs, which they prefer; the older and tougher leaves are commonly eaten only at their tip ends, and have irregular holes of various sizes gnawed in them, some of these holes being no larger than a puncture made with a pin. The green succulent ends of the twigs are also frequently eaten off. And the young apples, which were nearly as large as walnuts when these worms made their appearance, almost without exception had either round holes or larger irregular cavities gnawed in their surface. Thus wounded they wilt and fall from the tree, a few only having the wounds so slight that they recover and remain upon the tree until they ripen."

The moth into which the Palmer worm transforms closely resembles the *Gelechia* of the granaries. It is of an ash gray color, with six or seven equidistant black dots at the base of the fringe on the outer edge of the wing. In the middle of the wing are four larger dark dots, which are placed obliquely with regard to each other; the wings expand between a half and three-quarters of an inch. It belongs to the family of *Tineids*, which have small, narrow wings, with long, silky fringes. The common clothes moth is a type of the family. Fitch recommends showering the



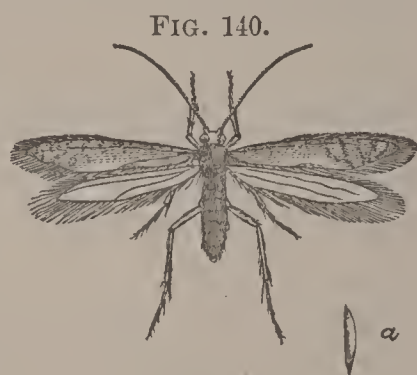
trees with whale-oil soap diluted with water. Frequent drenchings, natural as well as artificial, are extremely useful in ridding trees of caterpillars, and turning the hose on infested trees is an excellent remedy against all sorts of caterpillars, particularly the bud worm and Palmer worm.

*The Twin Spotted Leaf Miner.*—Another of that exquisite family, the Tineids, often infests the apple in immense numbers, mining the leaves, leaving a serpentine blotch to mark the site of its gallery. It bears the sesquipedalian name of *Lithocolletis geminatella*. It is figured in all its stages on plate 8 of the "Guide to the Study of Insects." The little caterpillar is slightly over a line in length ( $\cdot 14$  inch), of a pale livid reddish hue with a black head, the segment behind the head being also blackish. When it becomes fully fed it transforms into a chrysalis within its mine. When disturbed it crawls rapidly out of its domicile and hangs suspended by a thread, unwittingly open to the attacks of the smaller birds, to whom all these minute leaf-rolling and mining caterpillars are a dainty tit bit. Indeed, were it not for the kind offices of these feathered friends of ours, these tiny thieves would leave no food for their giant friends, the canker worms and tent caterpillars. The worms occur throughout the last of summer and early autumn, while the moths first appeared in Salem on the 19th of August, flying in doors during the night, attracted by the light. It is a beautiful creature, with long, narrow, delicate wings fringed with long lashes, with a yellowish tuft of hairs on the top of the head. It is of a dark slate gray color, with an eye-like spot at the end of the fore wings, pupilled with black, like the "eye" in a peacock's tail.

*The Apple Bucculatrix.*—Closely resembling in its general appearance the preceding moth, this beautiful form is much paler, almost whitish, with yellowish scales, and a curved black line curving around to the apex of the wing, ending in an eye-like spot on the outer edge; in the middle of the

wing is a black oval spot. The caterpillar I have not detected. It is described, however, by Dr. Clemens as being dark yellowish green, tinged with reddish in front, with a brown head. It was found feeding externally on the leaves, late in September. Early in October it changes to a chrysalis within a long white cocoon, slenderer, but about as long as a grain of rice; it is tough and thick, and ribbed externally. It is a common object, found attached to the bark of the tree in May as well as the autumn and winter. These little moths are not exempt from parasitic ichneumons of exceeding minuteness, which send them to an early grave. Indeed the mortality among moths is greatest during their childhood, when they are in the chrysalis state. While a

few caterpillars, like very many human children, die of over-eating, the greater number of deaths are due to causes beyond the control of the caterpillar. In Europe, twelve hundred species of minute, chalcid ichneumon flies are known to exist, and of these many prey on the Tineids. I have found a most singular form preying on the Bucculatrix of the cedar (*B. thuiella*, Fig. 140, enlarged; *a*, cocoon, natural size), which closely



*Bucculatrix thuiella*.

resembles the apple moth. In endeavoring to rear the moth from the cocoon I found that nearly half of the cocoons gathered from a cedar tree in my yard, failed to give out their appropriate tenant, but instead, rendered account in the form of minute beautifully brilliant green flies, with golden metallic tints. The antennæ branched out like the antlers of a reindeer, each having at the end five branches, somewhat resembling a Japanese comb. These little flies are worth far more than their weight in gold, and were their worth duly appreciated our gardeners would look upon the

cultivation of ichneumon flies as the "right arm of the service" in an enlightened agriculture.

*The Apple Micropteryx*.—The most abundant leaf miner of the apple, so busy a laborer that for several years past nearly every other leaf on the apple trees in my garden witnesses their plodding, patient work, is the *Micropteryx pomivorella*—nearly all these minute slender-winged moths have monstrously long names.

The caterpillar is a minute, dark, pea-green, flat worm, the body thickest in the middle and very soft. It is about a line in length. It eats its way in the interior of the leaf, between the upper and the under side, feeding on the soft pulp. Its burrow is marked by a broad waved dark line on the leaf, which widens at the farther end, and is somewhat puffed out, owing to the presence of the fully fed caterpillar. In this little terminal chamber the worm rests, and when anxious to leave it in order to spin its cocoon effects its escape through a slit, which it has had the instinct or common sense previously to cut with its jaws. So abundant is it, that multitudes of these little green worms may be seen hanging helplessly from the leaves of the tree. Suspended by this thread they swing to and fro, until they strike some twig, whence they go to the bark of the trunk and larger branches. Here in warm days late in September and early in October, the worms spin a peculiar flattened, round, silken, yellow cocoon, about a line in diameter. In confinement I have noticed that it will spin its cocoon on the leaves, but in nature it is careful to deposit them on the branches, where it remains through the winter. The larva completes the cocoon, at least all that is visible, within the space of one hour. The moth was found in considerable abundance resting on the under side of apple-leaves the 19th of June.

The body and wings are of an uniform dark bronze hue, with purple and metallic reflections; the fringe is concolo-



rous with the wings. On the top of the head is a conspicuous bushy tuft of bright reddish orange hairs. The legs are of a leaden hue, the hairs yellowish, the hind shanks long and hairy, with four long, slender spurs; the antennæ are dark on the terminal three-fourths, pale orange at base. The under side of the wings are leaden gray. The length of the body is .07, and of the body including the folded wings, one-tenth of an inch.

*The Sac Bearer.*—Another winged gem, with a still more curious childhood than the *Micropteryx*, is a sac bearer, as the Germans call it. Like a boy in a meal sack, with his arms sprawling about and pulling himself along, the little caterpillar pokes its head out of its case, extends its six fore legs, like so many hands, and pulls itself over the leaf, its little world. The worm is flattened, green, and no thicker than a small knitting needle. The case or sac is oval, open at each end, much flattened and roomy enough for its inhabitant to turn around in. How the case is constructed we have been unable to observe. While some sac bearers cut an oblong slit in the leaf, fold it over, and then cutting a corresponding slit remove the folded portion, fasten together with silk the open side, wriggle into this straight jacket, and walk off as if they had been born with their houses on their backs; others probably construct their cases out of fine bits of leaf stuck together with the silken glue secreted from the glands emptying into their mouths. The material of such cases resembles a thick, felt-like cloth, and that of our sac bearer is of this nature. By the end of August the caterpillar becomes mature and ready to transform into a chrysalis. It does not desert its old coat, but hangs it by a few threads to the bark of the tree and contracts its body, lies quiet through the winter, until early in summer the chrysalis breaks through a rent in its skin and soon after the moth appears. It is now one of the most beautiful objects in nature. It is very small, the head finely dusted, its softly

fringed wings expanding only a fifth of an inch. Its fore wings are of a light slate gray color on their inner half, and beyond bright orange, enclosing two white bands, one situated on the front edge, and the other arising from the inner edge, both nearly meeting in the middle of the wing, and edged externally with black. There is a very conspicuous square black spot near the fringe, in which is a long pencil of black hairs. Such startling contrasts of yellow and black are seldom worn by these diminutive moths, but nature never outrages our notions of good taste, and these colors are blended in an harmonious and attractive way. It is doubtful whether these little sac bearers ever do any mischief to the trees, and they are more interesting than injurious. The moth, caterpillar and case are figured on the frontispiece of the "Guide to the Study of Insects."

*The Apple Aphis* (Fig. 141, natural size and enlarged).—The prick of a plant louse and loss of a drop or two of sap

FIG. 141.



The Apple Aphis.

is of little moment to an apple tree ; so is the loss of a drop of water to a pond. But multiply the number of lost drops and the pond may dry up and the tree wither and die. The vast numbers of Aphides, often seen clustering two to three deep on the green shoots of a favorite tree in the orchard, is a lamentable spectacle. The work to be done by these insects is such as, unfortunately for the gardener, to require vast numbers. Every gap opened in their ranks, by the as-

saults of the myriad birds and insects which prey upon them, must be closed by accessions from the youth of the colony. How fertile the mothers are in means to supply this want, and with what startling precocity the new-born Aphis steps into the shoes of his sire, or more commonly his mother, we have already seen. Given a colony of, say, 1,000,000 plant lice on a choice tree, the problem before us, and it is one nature daily presents, is to reduce the 1,000,000 to 0.

Before using the various artificial remedies, excellent when faithfully applied, the intelligent gardener will avail himself of the aid of the natural enemies of the Aphis, such as the maggot of the *Syrphus* fly, and the larva of the lace-winged fly. If he gather these and turn them loose among the flocks of Aphides his withered trees will soon become green and exuberant.

Dr. Fitch says that the eggs are small, oval, shining, black, and placed by the parent in autumn deep in the cracks and crevices in the bark of the tree. Now, as he suggests, the practical way to deal with these pests is to scrape off the dead bark of the old trees and whitewash all the trunks early in November, or very early in the spring before the buds begin to open, for at this period the young Aphides hatch, as they may be found clustered round the buds, and as soon as the green leaves begin to show themselves the Aphides puncture them. This Aphis is a European importation. The head and thorax are black, the hind body green. Among the remedies which may be applied are washes of sal soda, strong soap suds, tobacco in solution or its smoke, though this latter means is difficult to apply to any except choice small trees.

Not content with the destruction to root, trunk and leaf, a few insects devote their energies to

#### INJURING THE FRUIT.

*The Coddling Moth.*—Many a housekeeper looks with unconcern upon this little creature, quite ignorant of the mis-



chief it has done in the orchard, and that it is the cause of the wormy apples in the cellar. So with the average farmer or gardener. He little suspects that the apples falling in a still night from his trees are loosened from their twig by the young of the innocent looking moth which may be seen flying about the house, when the apple trees are in blossom, and again in the middle of August, when the apples are half formed. Many may recall the appearance of the repulsive little whitish caterpillar or "worm," occurring in wormy apples, who are not at all acquainted with the moth. It is rather smaller than the apple leaf roller, with narrower wings, and grayish ash-colored. Across the wings pass slightly marked numerous darker transverse lines, with a prominent curved black line, edged with a coppery tint, near an eye-like patch on the inner angle. The wings expand over half an inch. She lays her eggs in the calyx of the blossoms of the apple, just as the petals are falling. The worm hatches in a few days, burrowing into the core. In three weeks the caterpillar becomes full-sized, the apple prematurely drops, the worm deserts it, creeps up under the bark of the tree, cocooning and in a few days after a brood of moths appear. They are the parents of the worms which may be found through the winter and early spring under the bark, housed in their cocoons.

Taking advantage of this habit of cocooning in crevices, the best plan in dealing with these insects is to wind cloths and bands of straw around the trunks. During the last half of summer and the autumn they can be removed every few days and burned, and others put in their place.

When the fruit is stored in the cellar the maggots of three kinds of flies emulate the example of the caterpillar of the codling moth, and further despoil the orchardist, and wound the feelings of the lover of good apples.

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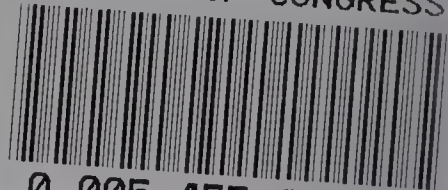
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